

## PATENT ABSTRACTS OF JAPAN

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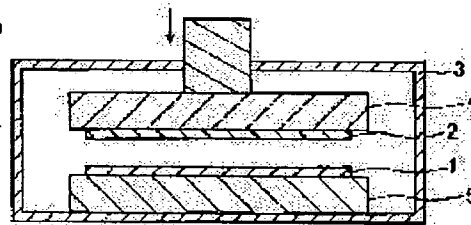
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### (54) MANUFACTURING METHOD AND MANUFACTURING DEVICE FOR LIQUID CRYSTAL DISPLAY ELEMENT

#### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a manufacturing method and a manufacturing device for a liquid crystal display element in which warpage is not generated after a polarizing plate is stuck even if a resin substrate is used.

**SOLUTION:** In a stage for sticking a liquid crystal display element 1 formed by encapsulating a liquid crystal between a first resin substrate on which a transparent electrode pattern is formed and a second resin substrate to the polarizing plate 2 on which a tacky layer or an adhesive layer is formed for adhering the polarizing plate to the one surface of the first or the second substrate, a pair of surface plates 4 and 5 which can be freely displaced are provided in a chamber, the liquid crystal display element 1 is placed on one surface plate 5, the polarizing plate is sucked to the other surface plate 4 having a sucking hole or groove for sucking so as to obtain pressure lower than the pressure in the chamber, the liquid crystal display element and the polarizing plate are aligned and stuck to each other and then the internal part of the chamber is pressurized.



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**CLAIMS**

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[Claim(s)]

[Claim 1] In the process which sticks the polarizing plate with which the adhesive layer or the glue line was formed in one field of the liquid crystal display component which enclosed liquid crystal between the 1st resin substrate and the 2nd resin substrate with which the transparent electrode pattern was formed, and the said 1st substrate or the 2nd substrate Form the surface plate of a pair which can be freely displaced in a tub, and said liquid crystal display component is installed in one surface plate. The manufacture approach of the liquid crystal display component characterized by pressurizing the inside of a tub after making said polarizing plate stick to the surface plate of another side which has the adsorption hole or slot which carries out inhalation of air so that it may become low voltage from the pressure in a tub, carrying out alignment of said liquid crystal display component and said polarizing plate and sticking them.

[Claim 2] In the equipment which sticks the polarizing plate with which the adhesive layer or the glue line was formed in one field of the liquid crystal display component which enclosed liquid crystal between the 1st resin substrate and the 2nd resin substrate with which the transparent electrode pattern was formed, and the said 1st substrate or the 2nd substrate Form the surface plate of a pair which can be freely displaced in a tub, and said liquid crystal display component is installed in one surface plate. The manufacturing installation of the liquid crystal display component characterized by having a means to make said polarizing plate stick to the surface plate of another side which has the adsorption hole or slot which carries out inhalation of air so that it may become low voltage from the pressure in a tub, to carry out alignment of said liquid crystal display component and said polarizing plate, and to stick them, and a means to pressurize the inside of a tub.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of the liquid crystal display component which consists of a resin substrate, and a manufacturing installation.

[0002]

[Description of the Prior Art] In the liquid crystal display component, holding a liquid crystal layer in fixed thickness, and in order to form an electrode, generally the glass substrate is used from the former as a substrate.

[0003] A liquid crystal display component is installed on a surface plate, when sticking a polarizing plate on the liquid crystal display component using a glass substrate, the polarizing plate in which the adhesive layer was formed to one field is arranged so that an adhesive layer side may be on a liquid crystal display component side, the approach of sticking, while pressurizing with a roller from the field which does not form the adhesive layer of a polarizing plate toward the opposite side from one side of a polarizing plate is common, and attachment is performed while an adhesive layer forming face deforms a polarizing plate into convex with a roller.

[0004] Although the modulus of elasticity of glass is  $7.0 \times 10^{10}$  to  $8.0 \times 10^{10}$  Pa, the modulus of elasticity of  $1.2 \times 10^9$  Pa and triacetyl cellulose is  $3.2 \times 10^9$  Pa, and that of the modulus of elasticity of the polyvinyl alcohol which is the ingredient of a polarizing plate is small a single figure as compared with it of glass.

[0005] Therefore, when the attachment side side of a polarizing plate deformed into convex at the time of attachment, the liquid crystal display component did not deform with the rigidity of glass, and curvature did not occur for a liquid crystal display component.

[0006]

[Problem(s) to be Solved by the Invention] On the other hand, the elastic modulus of the polyether sulfone of the resin ingredient which can be used as a resin substrate  $2.5 \times 10^9$  Pa, The elastic modulus of a polycarbonate the elastic modulus of  $1.8 \times 10^9$  Pa and acrylic resin From  $1.8 \times 10^9$  Pa to  $3.2 \times 10^9$  Pa The elastic modulus of an epoxy resin is as near a value as  $3.0 \times 10^9$  Pa and the elastic modulus of a polarizing plate ingredient, and when it sticks making a polarizing plate curl using a roller like the case of a glass substrate for the liquid crystal display component created using these resin substrates, curvature generates [ a polarizing plate side ] it in a concave. Moreover, since the liquid crystal display component has curved when sticking a polarizing plate on the field on which the polarizing plate is not stuck similarly, there are a problem that alignment with a polarizing plate is not fully made, and a problem that air bubbles arise between a liquid crystal display component and a polarizing plate.

[0007] Even if a resin substrate is used for it, this invention aims at offering the manufacture approach of a liquid crystal display component and manufacturing installation which curvature does not generate after polarizing plate attachment, in order to solve said conventional problem.

[0008]

[Means for Solving the Problem] In order to attain said purpose, the manufacture approach of the liquid crystal display component of this invention In the process which sticks the polarizing plate with which the adhesive layer or the glue line was formed in one field of the liquid crystal display

component which enclosed liquid crystal between the 1st resin substrate and the 2nd resin substrate with which the transparent electrode pattern was formed, and the said 1st substrate or the 2nd substrate Form the surface plate of a pair which can be freely displaced in a tub, and said liquid crystal display component is installed in one surface plate. Said polarizing plate is made to stick to the surface plate of another side which has the adsorption hole or slot which carries out inhalation of air so that it may become low voltage from the pressure in a tub, and after carrying out alignment of said liquid crystal display component and said polarizing plate and sticking them, it is characterized by pressurizing the inside of a tub.

[0009] Next, the liquid crystal display component with which the manufacturing installation of the liquid crystal display component of this invention enclosed liquid crystal between the 1st resin substrate and the 2nd resin substrate with which the transparent electrode pattern was formed, In the equipment which sticks the polarizing plate with which the adhesive layer or the glue line was formed in one field of said 1st substrate or the 2nd substrate Form the surface plate of a pair which can be freely displaced in a tub, and said liquid crystal display component is installed in one surface plate. Said polarizing plate is made to stick to the surface plate of another side which has the adsorption hole or slot which carries out inhalation of air so that it may become low voltage from the pressure in a tub, and it is characterized by having a means to carry out alignment of said liquid crystal display component and said polarizing plate, and to stick them, and a means to pressurize the inside of a tub.

[0010] According to this invention, in the liquid crystal display component using a resin substrate, the liquid crystal display component which does not have curvature after polarizing plate attachment can be offered.

[0011]

[Embodiment of the Invention] The example of this invention is explained below.

[0012] (Example 1) The pixel electrode was formed by etching, using 50mmx50mm and an acrylic substrate with indium tin oxide (henceforth, ITO) with a thickness of 0.4mm as a substrate. Subsequently, the orientation film which consists of polyimide resin on ITO was printed, and after carrying out baking formation, rotation rubbing using a rayon cloth performed orientation processing so that liquid crystal in the STN mode 250-degree twist might be realized.

[0013] and — the perimeter part on one substrate — glass fiber — 1.0wt(s)% — the mixed photoresist seal resin was printed, and on the substrate of another side, 2 came out of 300 resin beads /of a predetermined path comparatively mm, it sprinkled, and these substrates were mutually heat-hardened at 130 more degrees C after hardening seal resin with the lamination high-pressure mercury lamp. Then, after carrying out vacuum impregnation of the liquid crystal mixture which mixed the chiral agent of a predetermined amount with the ester system nematic liquid crystal of rate  $\Delta n = 0.14$  and obturating by photo-curing resin, it heat-treated after hardening by UV irradiation, and the resin substrate liquid crystal display component 1 was obtained.

[0014] Drawing 1 shows the manufacture approach of the liquid crystal display component in the example 1 of this invention. In the pressurization tub 3 of drawing 1, there are surface plates 4 and 5 of a vertical pair which can displace at least one side, the resin substrate liquid crystal display component 1 is installed at the downward surface plate 5, it decompressed and the polarizing plate 2 was made to adsorb so that an adhesive layer side may be to the upper surface plate 4 on the resin substrate liquid crystal display component 1 side. Checking location adjustment so that the resin substrate liquid crystal display component 1 and a polarizing plate 2 may acquire a necessary doubling precision, after making the inside of the pressurization tub 3 into the pressure of 0.01MPa(s), the vertical surface plates 4 and 5 were operated, the inside of lamination and the pressurization tub 3 was pressurized for the resin substrate liquid crystal display component 1 and the polarizing plate 2 at 0.2MPa(s), and the resin substrate liquid crystal display component was obtained.

[0015] And it evaluated about the curvature of the resin substrate liquid crystal display component of an example 1. Evaluation of curvature placed downward the field which stuck the polarizing plate for the resin substrate liquid crystal display component on the flat display case, measured the height

from a flat display case, and was made into the amount of curvatures.

[0016] Consequently, with the liquid crystal display component of an example 1, it was 0mm in height, and curvature was not generated but the good result was obtained.

[0017] (Example 1 of a comparison) The resin substrate liquid crystal display component 1 was produced like the example 1 as an example 1 of a comparison. Drawing 2 shows the manufacture approach of the conventional liquid crystal display component in the example 1 of a comparison. Install the resin substrate liquid crystal display component 1 on the surface plate 11 which can be displaced, and a polarizing plate 2 is made to adsorb so that an adhesive layer side may be to the upper adsorption machine 12 on the resin substrate liquid crystal display component 1 side. Checking location adjustment so that the resin substrate liquid crystal display component 1 and a polarizing plate 2 may acquire a necessary doubling precision Stick one side of a polarizing plate 2 on the predetermined side of the resin substrate liquid crystal display component 1, and the roller 13 of a predetermined diameter is moved toward the side of opposite from the side, pressurizing a polarizing plate 2 by the predetermined pressure. After the polarizing plate 2 separated from the adsorption machine 2, the roller was made to reach to the side of opposite, the polarizing plate 2 was stuck on the resin substrate liquid crystal display component 1, and the resin substrate liquid crystal display component was obtained.

[0018] And it evaluated like the example 1 about the curvature of the resin substrate liquid crystal display component of the example 1 of a comparison. In the example 1 of a comparison, the pressure of a roller was changed with 0.5 times of a predetermined pressure, 1 time, and twice. Consequently, with the liquid crystal display component of the example 1 of a comparison, the height of curvature is 7mm at the time of 6mm and twice at the time of 6mm and 1 time at the time of one 0.5 times the pressure of this, and the good result was not obtained.

[0019] In addition, although the polarizing plate was installed in the top board, the liquid crystal display component was installed in the lower lapping plate in the example and the liquid crystal display component was produced, also when a liquid crystal display component is installed in a top board, a polarizing plate is installed in a lower lapping plate and a liquid crystal display component is produced, without restricting to this, it is checking that the same result is obtained.

[0020]

[Effect of the Invention] In the process which sticks a polarizing plate on the liquid crystal display component which was with the resin substrate according to this invention as explained above Form the surface plate of a pair which can be freely displaced in a tub, and said liquid crystal display component is installed in one surface plate. By making said polarizing plate stick to the surface plate of another side which has the adsorption hole which carries out inhalation of air so that it may become the low voltage force from the pressure in a tub, and a slot, and having the process which pressurizes the inside of a tub, after carrying out alignment of said liquid crystal display component and said polarizing plate and sticking them The liquid crystal display component by which quality without curvature was stabilized can be offered.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The schematic diagram of the polarizing plate attachment equipment in one example of this invention

[Drawing 2] The schematic diagram of the polarizing plate attachment equipment in the example of a comparison

[Description of Notations]

- 1 Resin Substrate Liquid Crystal Display Component
- 2 Polarizing Plate
- 3 Pressurization Tub
- 4 Top Board
- 5 Lower Lapping Plate
- 11 Surface Plate
- 12 Adsorption Machine
- 13 Roller

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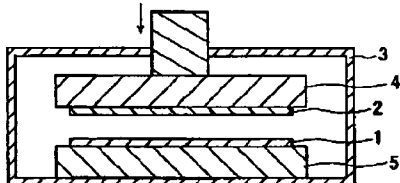
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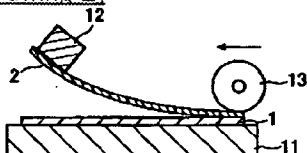
DRAWINGS

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[Drawing 1]



[Drawing 2]



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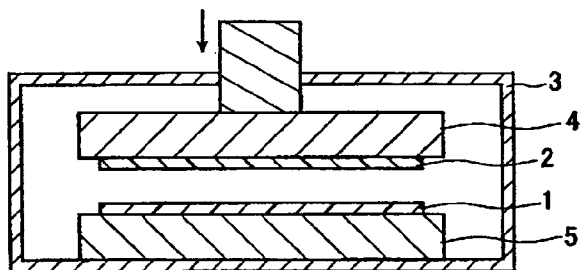
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(54) 【発明の名称】 液晶表示素子の製造方法及び製造装置

(57) 【要約】

【課題】 樹脂基板を用いても偏光板貼り付け後に反りが発生しない液晶表示素子の製造方法及び製造装置を提供する。

【解決手段】 透明電極パターンが形成された第1の樹脂基板と第2の樹脂基板との間に液晶を封入した液晶表示素子1と、前記第1基板または第2基板の一方の面に粘着層あるいは接着層が形成された偏光板2を貼りつける工程において、槽内に変位自在の一对の定盤4、5を設け、一方の定盤5に液晶表示素子1を設置し、槽内の圧力より低圧となるように吸気する吸着穴または溝を有する他方の定盤4に偏光板を吸着させて、前記液晶表示素子と前記偏光板を位置合わせして貼りつけた後、槽内を加圧する。



## 【特許請求の範囲】

【請求項1】 透明電極パターンが形成された第1の樹脂基板と第2の樹脂基板との間に液晶を封入した液晶表示素子と、前記第1基板または第2基板の一方の面に粘着層あるいは接着層が形成された偏光板を貼りつける工程において、

槽内に変位自在の一对の定盤を設け、一方の定盤に前記液晶表示素子を設置し、槽内の圧力より低圧となるように吸気する吸着穴または溝を有する他方の定盤に前記偏光板を吸着させて、前記液晶表示素子と前記偏光板を位置合わせして貼りつけた後、槽内を加圧することを特徴とする液晶表示素子の製造方法。

【請求項2】 透明電極パターンが形成された第1の樹脂基板と第2の樹脂基板との間に液晶を封入した液晶表示素子と、前記第1基板または第2基板の一方の面に粘着層あるいは接着層が形成された偏光板を貼りつける装置において、

槽内に変位自在の一对の定盤を設け、一方の定盤に前記液晶表示素子を設置し、槽内の圧力より低圧となるように吸気する吸着穴または溝を有する他方の定盤に前記偏光板を吸着させて、前記液晶表示素子と前記偏光板を位置合わせして貼りつける手段と、槽内を加圧する手段とを備えたことを特徴とする液晶表示素子の製造装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、樹脂基板からなる液晶表示素子の製造方法及び製造装置に関するものである。

## 【0002】

【従来の技術】液晶表示素子において、液晶層を一定厚みに保持することと、電極を形成するために、基板としてガラス基板が従来から一般に用いられている。

【0003】ガラス基板を用いた液晶表示素子に偏光板を貼りつける場合、液晶表示素子を定盤上に設置し、一方の面に粘着層を形成した偏光板を粘着層面が液晶表示素子側になるように配置し、偏光板の一边からその対辺に向かって偏光板の粘着層の形成していない面からローラーで加圧しながら貼りつける方法が一般的であり、偏光板はローラーにより粘着層形成面が凸状に変形しながら貼り付けが行われる。

【0004】ガラスの弾性率は $7.0 \times 10^{10} \sim 8.0 \times 10^{10}$  Paであるが、偏光板の材料であるポリビニルアルコールの弾性率は $1.2 \times 10^9$  Pa、トリアセチルセルロースの弾性率は $3.2 \times 10^9$  Paであり、ガラスのそれと比較して1桁小さい。

【0005】そのため、貼りつけ時に偏光板の貼り付け面側が凸状に変形した場合においてもガラスの剛性により液晶表示素子は変形せず、液晶表示素子に反りが発生することは無かった。

## 【0006】

【発明が解決しようとする課題】一方、樹脂基板として使用が可能な樹脂材料のポリエーテルスルフォンの弾性率は $2.5 \times 10^9$  Pa、ポリカーボネートの弾性率は $1.8 \times 10^9$  Pa、アクリル樹脂の弾性率は $1.8 \times 10^9$  Paから $3.2 \times 10^9$  Pa、エポキシ樹脂の弾性率は $3.0 \times 10^9$  Paと偏光板材料の弾性率と近い値であり、これらの樹脂基板を用いて作成した液晶表示素子にガラス基板の場合と同様にローラーを用いて偏光板をカールさせながら貼りつけた場合、偏光板側が凹状に反りが発生する。また偏光板を貼りつけていない面に同様にして偏光板を貼りつける場合、液晶表示素子が反っている為、偏光板との位置合わせが十分にできないという問題、また液晶表示素子と偏光板の間に気泡が生じるという問題がある。

【0007】本発明は、前記従来の問題を改善するため、樹脂基板を用いても偏光板貼り付け後に反りが発生しない液晶表示素子の製造方法及び製造装置を提供することを目的とする。

## 【0008】

【課題を解決するための手段】前記目的を達成するため、本発明の液晶表示素子の製造方法は、透明電極パターンが形成された第1の樹脂基板と第2の樹脂基板との間に液晶を封入した液晶表示素子と、前記第1基板または第2基板の一方の面に粘着層あるいは接着層が形成された偏光板を貼りつける工程において、槽内に変位自在の一对の定盤を設け、一方の定盤に前記液晶表示素子を設置し、槽内の圧力より低圧となるように吸気する吸着穴または溝を有する他方の定盤に前記偏光板を吸着させて、前記液晶表示素子と前記偏光板を位置合わせして貼りつけた後、槽内を加圧することを特徴とする。

【0009】次に本発明の液晶表示素子の製造装置は、透明電極パターンが形成された第1の樹脂基板と第2の樹脂基板との間に液晶を封入した液晶表示素子と、前記第1基板または第2基板の一方の面に粘着層あるいは接着層が形成された偏光板を貼りつける装置において、槽内に変位自在の一对の定盤を設け、一方の定盤に前記液晶表示素子を設置し、槽内の圧力より低圧となるように吸気する吸着穴または溝を有する他方の定盤に前記偏光板を吸着させて、前記液晶表示素子と前記偏光板を位置合わせして貼りつける手段と、槽内を加圧する手段とを備えたことを特徴とする。

【0010】本発明によれば、樹脂基板を用いた液晶表示素子において、偏光板貼り付け後に反りのない液晶表示素子を提供することができる。

## 【0011】

【発明の実施の形態】以下に本発明の実施例について説明する。

【0012】（実施例1）基板として50mm×50mm、厚さ0.4mmのインジウムチンオキサイド（以下ITO）付アクリル系基板を用い、エッチングにより画素電極を形成した。次いでITO上にポリイミド樹脂からなる配向膜を印

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刷し、焼成形成した後、 $250^{\circ}$  ツイストのSTNモードの液晶を実現するようにレーヨン布を用いた回転ラビングにより配向処理を行った。

【0013】そして、一方の基板上の周囲部分にはガラスファイバを1.0wt%混入した光硬化性シール樹脂を印刷し、他方の基板上には所定の径の樹脂ビーズを300個/mm<sup>2</sup>の割合で散布し、これらの基板を互いに貼り合わせ高圧水銀ランプでシール樹脂を硬化後、さらに130℃で熱硬化した。その後、複屈折率 $\Delta n=0.14$ のエステル系ネマチック液晶に所定の量のカイラル剤を混ぜた混合液晶を真空注入し、光硬化樹脂で封口した後、紫外線照射により硬化後、熱処理し、樹脂基板液晶表示素子1を得た。

【0014】図1は、本発明の実施例における液晶表示素子の製造方法を示したものである。図1の加圧槽3内に、少なくとも一方が変位可能な上下一對の定盤4、5があり、樹脂基板液晶表示素子1を下方の定盤5に設置し、偏光板2を上方の定盤4に粘着層面が樹脂基板液晶表示素子1側になるように減圧して吸着させた。加圧槽3内を0.01MPaの圧力にした後、樹脂基板液晶表示素子1、偏光板2が所要の合わせ精度を得るように位置整合を確認しながら、上下定盤4、5を動作させ樹脂基板液晶表示素子1、偏光板2を貼り合わせ、加圧槽3内を0.2MPaに加圧し、樹脂基板液晶表示素子を得た。

【0015】そして、実施例1の樹脂基板液晶表示素子の反りについて評価した。反りの評価は樹脂基板液晶表示素子を平台の上に偏光板を貼りつけた面を下に置き、平台からの高さを測定し、反り量とした。

【0016】その結果、実施例1の液晶表示素子では高さ0mmであり、反りは発生せず、良好な結果が得られた。

【0017】（比較例1）比較例1として実施例1と同様にして樹脂基板液晶表示素子1を作製した。図2は比較例1における従来の液晶表示素子の製造方法を示したものである。変位可能な定盤11上に樹脂基板液晶表示素子1を設置し、偏光板2を上方の吸着機12に粘着層面が樹脂基板液晶表示素子1側になるように吸着させ、樹脂基板液晶表示素子1、偏光板2が所要の合わせ精度を得るように位置整合を確認しながら、偏光板2の一边を樹脂基板液晶表示素子1の所定の辺に貼りつけ、その

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辺から所定の直径のローラー13を偏光板2を所定の圧力で加圧しながら対向の辺に向かって移動させ、偏光板2が吸着機12から離れた後ローラー13を対向の辺まで到達させ、偏光板2を樹脂基板液晶表示素子1に貼りつけ樹脂基板液晶表示素子を得た。

【0018】そして、比較例1の樹脂基板液晶表示素子の反りについて、実施例1と同様にして評価した。比較例1ではローラーの圧力を所定の圧力の0.5倍、1倍、2倍と変化させた。その結果、比較例1の液晶表示素子では反りの高さは、圧力0.5倍のとき6mm、1倍のとき6mm、2倍のとき7mmであり、良好な結果は得られなかった。

【0019】尚、実施例において上定盤に偏光板、下定盤に液晶表示素子を設置し液晶表示素子を作製したが、これに限ることなく上定盤に液晶表示素子、下定盤に偏光板を設置して液晶表示素子を作製した場合も同様の結果が得られることを確認している。

【0020】

【発明の効果】以上説明したように本発明によれば、樹脂基板をもちいた液晶表示素子に、偏光板を貼りつける工程において、槽内に変位自在の一対の定盤を設け、一方の定盤に前記液晶表示素子を設置し、槽内の圧力より低圧力となるように吸気する吸着穴や溝を有する他方の定盤に前記偏光板を吸着させて前記液晶表示素子と前記偏光板を位置合わせして貼り合わせた後、槽内を加圧する工程とを有することにより、反りのない品質の安定した液晶表示素子を提供することができる。

【図面の簡単な説明】

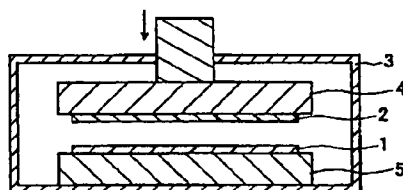
【図1】本発明の一実施例における偏光板貼りつけ装置の概略図

【図2】比較例における偏光板貼りつけ装置の概略図

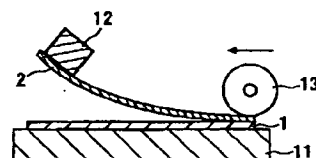
【符号の説明】

- 1 樹脂基板液晶表示素子
- 2 偏光板
- 3 加圧槽
- 4 上定盤
- 5 下定盤
- 11 定盤
- 12 吸着機
- 13 ローラー

【図1】



【図2】



フロントページの続き

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